

REMARKS/ARGUMENTS

Favorable reconsideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 1-5, 7-9, 11, 12, 17-24, and 27-48 are pending. Claims 6, 10, 25, and 26 were previously canceled without prejudice or disclaimer. Claims 13-16 are presently canceled without prejudice or disclaimer.

Claims 1, 2, 4, and 5 are presently amended and previously presented Claims 1, 2, 4, and 5 provide clear support for such amendment. Claims 29-32 are also amended and the specification, for example at page 6, lines 24-35, provides clear support for these amendments. Newly added Claim 33 is clearly supported by previously presented Claim 1 and the specification, for example, at page 6, lines 24-35. Newly added Claims 34-37 and 46 are clearly supported by respective previously presented Claims 1, 2, 4, 5, and 29 and the specification, for example, at page 7, lines 10-13. Newly added Claims 38-41 and 47 are clearly supported by the specification, for example, at page 7, lines 10-13. Newly added Claims 42-45 and 48 are clearly supported, for example, by canceled Claims 13-16.

In the outstanding Office Action, Claims 1-5, 7-9, 11-24, and 27-32 were provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over Claims 1-28 of U.S. Application No. 10/387,452; Claims 1-4, 9, 21-23, and 27-31 were rejected under 35 U.S.C. §102(b) as anticipated by Kawada et al. (U.S. Patent No. 5,665,260, hereinafter Kawada); Claims 5, 7, 11, 24, 30, and 32 were rejected under 35 U.S.C. §103(a) as unpatentable over Kawada in view of Noda et al. (U.S. Patent Number 5,753,893, hereinafter Noda); Claims 8 and 12 were rejected under 35 U.S.C. §103(a) as unpatentable over Kawada in view of Yamada et al. (U.S. Patent Number 5,998,320, hereinafter Yamada); Claims 13-15 were rejected under 35 U.S.C. §103(a) as unpatentable over Kawada in view of Ushikawa et al. (U.S. Patent Number 6,140,256,

hereinafter Ushikawa); Claim 16 was rejected under 35 U.S.C. §103(a) as unpatentable over Kawada in view of Noda, and further in view of Ushikawa, Claim 19 was rejected under 35 U.S.C. §103(a) as unpatentable over Kawada in view of Nozaki et al. (U.S. Patent Number 5,264,681, hereinafter Nozaki); and Claim 20 was rejected under 35 U.S.C. §103(a) as being unpatentable over Kawada in view of Noda, and further in view of Nozaki.

Initially, it is noted that the abandonment of U.S. Application No. 10/387,452 renders the provisional rejection of Claims 1-5, 7-9, 11-24, and 27-32 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over Claims 1-28 of this U.S. Application moot.

Applicants thank Examiner Fastovsky for the interview granted Applicants' representative on August 23, 2005. During the interview, the claimed invention was discussed with respect to the cited references.

In this last regard, Applicant's representative noted that independent Claims 1, 2, 4, and 5, all provide for a work-heating surface that has to be configured to either directly contact the work to be heated or to face that work to be heated across a "space" provided between the work-heating surface and the work to be heated. It was then noted that newly applied Kawada includes electrodes for electrostatic chucking, and that the Kawada taught electrostatic chucking involves a wafer being electrostatically fixed to the heater as discussed at col. 1, lines 17-19 of Kawada and at page 25, line 32, to page 26, line 2, of our specification.

Therefore, it was urged that the electrostatic chuck taught by Kawada clearly would result in the covering layer of the Kawada heater being in contact with the work to be heated. It was further urged that the only recitation of the work-heating surface relationship to the work to be heated that was relevant in independent Claims 1, 2, 4, and 5 was the one

specifying that the work-heating surface is in direct contact (“contact directly”) with the work, i. e., the cover layer of Kawada would be in direct contact with the work being heated.

Accordingly, it was further urged that while each of the supporting substrate, the electrode layer for the electrostatic chuck, and the heat generating layers are suggested by Kawada to have a surface roughness R_{max} of 5 μm or larger, no similar teaching or suggestion was present in Kawada as to providing the work contacting face of the covering layer with any particular roughness of the covering layer.

In this last regard, note that the teaching of Kawada is that the supporting substrate, the electrode layer for the electrostatic chuck, and the heat generating layers are roughened to increase bonding strength by providing an anchoring effect to prevent separation of the bonded parts after repeated cycles of heating and cooling. See col. 2, lines 53-59. .

The Examiner responded that he viewed the recitation of these independent claims that the ceramic substrate has a work-heating surface that is configured to “face a work to be heated across a space between the work-heating surface and the work to be heated” as being broad. Thus, the Examiner urged that it was reasonable in his view to read the “space” as a separation being provided by anything so that a work-heating surface, like a surface of the heat generating layer of Kawada, is not in direct contact with the work to be heated. He further noted that he viewed the supporting substrate and covering layer of Kawada as providing such a “space” in terms of distancing the work-heating surface from the work to be heated.

The examiner further noted that the specification did not provide any discussion or definition of this claimed “space between the work-heating surface and the work to be heated.” Thus, even though the Examiner agreed that the specification at page 7, lines 30-31, teach that the work can be heated “while it is held apart at a given distance from the heating surface,” it was noted that nothing was said as to what occupied this “given distance from the

heating surface.” Accordingly, the Examiner noted that he was of the view that the covering layer and/or substrate portion between the heat producing layer and the work could be reasonably interpreted to be providing the claimed “space.”

The examiner further noted that his review of the specification on this point indicated to him that the specification did not provide needed antecedent basis for the claimed term “space.” Accordingly, he suggested that the specification should be amended to provide such antecedent basis by incorporating the term “space” to describe the distance between the work and the work-heating surface.

Consequently, the paragraph beginning at page 6, line 24, of the specification has been amended at line 26 to clarify that there is a “space between the work and the heating surface.”

Moreover, the language of independent Claims 1, 2, 4, and 5 has been modified by deleting the recital “or to face a work to be heated across a space between the work-heating surface and the work to be heated.” Accordingly, as it is believed to be clear that as the covering layer of the Kawada ceramic heater must be the Kawada ceramic heater portion in direct contact with the work to be heated, the anticipation rejection previously applied as to independent Claims 1, 2, 4, and 5 should be withdrawn. In this regard, Kawada cannot be said to teach or suggest providing any particular roughness for this work contacting covering layer as fully discussed above and at the August 23, 2005, meeting with the examiner

As fully explained in the last response, Claims 1, 2, 4, and 5, recite that the work-heating surface “has a JIS B 0601 surface roughness of $R_{max} = 0.2$ to $200 \mu m$ ” because the inventors discovered the cause-and-effect relationship between the surface roughness of the work-heating surface and obtaining a uniform temperature of the work being heated. As further fully explained at page 11 of the Supplemental Amendment filed March 31, 2005:

If the surface roughness of the work-heating surface is too small, the area of contact between the work and the work-heating surface becomes too

large when the work is placed and heated on the work-heating surface. The temperature difference in the work-heating surface is reflected to the work, and the temperature difference in the work becomes large (see appended Fig. 1B). Even when the work is held apart from the work-heating surface, the atmospheric gases (air, reactive gas, and the like) between the work and the work-heating surface flow easily to the work and deprive the work of heat, and the result is that a temperature difference is generated in the work

As further noted at page 11 of the Supplemental Amendment filed March 31, 2005:

Conversely, if the surface roughness of the work-heating surface is too large, atmospheric gases remain in the spaces among the irregularities of the work-heating surface (valleys) or at the spaces between the work and the work-heating surface. This causes accumulation of heat and leads to a large temperature difference of the work

As further noted at pages 11-12 of the Supplemental Amendment filed March 31, 2006:

The above effects are shown in a comparison of exemplary examples included in the Applicants' specification. In exemplary Comparative Example 7, wherein R_{\max} is $210\ \mu\text{m}$, the temperature difference of the work, that is, the difference between the highest and the lowest temperatures was as big as 8°C .¹ In exemplary Comparative Example 6, R_{\max} is as small as $0.03\ \mu\text{m}$, but the difference between the highest and the lowest temperatures was also as big as 8°C .² Conversely, in the corresponding exemplary examples, the temperature differences of the work were small: in Example 9 ($R_{\max} = 6\ \mu\text{m}$), it was 3°C ; in Example 10 ($R_{\max} = 180\ \mu\text{m}$), it was 4°C . The Applicants respectfully submit that the results of the above-described comparative examples is objective evidence of nonobviousness under M.P.E.P. §716.01(a). Further, the importance of the dependency of the relationship between the surface roughness of the work-heating surface and uniform heating of the work is clear from the above results, and these comparative results must be given weight as evidence, not mere arguments. See In re Margolis, 228 U.S.P.Q. 940 (Fed. Cir. 1986). It is further noted that evidence of superiority, like these comparative examples, is enough to establish nonobviousness. See In re Chupp, 2 U.S.P.Q. 2d 1437, 1439 (Fed. Cir. 1987). Therefore, as the above discussed effect of the present invention is unexpected and not found in any of the cited references, the withdrawal of the rejections in the outstanding Action is believed to be in order.

In addition, it is clear that when the work-heating surface that is configured to contact directly with the work is roughened as claimed in independent Claims 1, 2, 4, and 5, (" $R_{\max} = 0.2$ to $200\ \mu\text{m}$ "), there is the added benefit disclosed at page 7, lines 26-31, of the

¹ Applicants' specification, page 36, lines 26 to 31 (results are shown in Table 2 on page 39).

² Applicants' specification, page 29, lines 21 to 25 (results are shown in Table 2 on page 39).

specification that the work is protected from contamination by the impurities from the ceramic substrate.

Accordingly the rejection of independent Claims 1, 2, and 4 as being anticipated by Kawada under 35 U.S.C. §102(b) is respectfully traversed, and it is respectfully submitted that this rejection should be withdrawn.

Moreover, as Noda does not cure the above noted deficiencies of Kawada, the rejection of independent Claim 5 as being unpatentable over Kawada in view of Noda under 35 U.S.C. §103(a) is also traversed for the reasons noted above. Moreover, this rejection of Claim 5 is traversed as the teachings of Noda have been misconstrued. In this regard, Noda teaches alumina as a sintered material for a ceramic heater. However, the claim requires a nitride ceramic substrate that contains at least one of “Na, B, Y, Li, Rb and Ca,” not a sintered alumina. Also the Noda suggestion of improving density and durability clearly relate to the suggested sintered alumina with additives. Thus, not only would the result of combining Kawada and Noda not be the nitride ceramic substrate that contains at least one of “Na, B, Y, Li, Rb and Ca” of Claim 5, there is no presentation of any actual motivation that would have led the artisan to attempt the combination.

Furthermore, as Claims 3, 21, and 27 depend from Claim 1, Claims 9, 22, and 28 depend from Claim 2, Claims 23 depends from Claim 4, and Claims 11 and 24 depend from Claim 5, the rejections thereof along with their respective independent claims as being anticipated by Kawada under 35 U.S.C. §102(b) or as being unpatentable over Kawada in view of Noda under 35 U.S.C. §103(a) are also traversed for all the above noted reasons set forth as to these respective independent claims.

Moreover, and as noted above, as Noda does not cure the above-noted deficiencies of Kawada, the rejection of Claim 7 (that is dependent on independent Claim 4) as being unpatentable over Kawada in view of Noda under 35 U.S.C. §103(a) is also traversed.

The rejection of Claims 8 and 12 under 35 U.S.C. §103(a) as unpatentable over Kawada in view of Yamada is also traversed. In this regard, Yamada is like Noda in that it fails to correct the above-noted deficiencies of Kawada. Therefore, even if the teachings of Yamada were used to modify Kawada, the result would not be the subject matter of either independent Claim 4 that is the parent claim for Claim 8, or that of independent Claim 5 that is the parent claim for Claim 12. Moreover, as Claim 12 does depend on Claim 5 and, thus, include all the limitations of Claim 5, the rejection of Claim 12 over only Kawada in view of Yamada, without reliance on Noda that was relied on to reject Claim 5, appears to be an error. In any event, to the extent that it was intended that Noda was also relied upon to reject Claim 12, such a rejection is traversed as to improper reliance on Noda, as set forth above, and because neither Noda nor Yamada cure the above-noted deficiencies of Kawada.

The rejection of Claims 13-15 under 35 U.S.C. §103(a) as unpatentable over Kawada in view of Ushikawa is believed to be moot in view of the cancellation of these claims. However, as the subject matter of these claims has been essentially incorporated into new Claims 42-45 and 48 that ultimately respectfully depend from new independent Claims 34-37 and 46, these claims, and independent Claims 29-33, are discussed next.

First of all it is noted that independent Claims 29-32 have been amended to recite that the “space between the work-heating surface and the work to be heated” is a “space” that “is occupied by a gas.” Note again the specification at page 6, lines 32-35, for example. In addition, new independent Claim 33 has been added that parallels independent Claim 1, but specifies that the work-heating surface “is configured to face a work to be heated across a space between the work-heating surface and the work to be heated,” where this “space is occupied by a gas” instead of reciting the direct contact of Claim 1.

As explained above, Kawada includes electrodes for electrostatic chucking, and this Kawada taught electrostatic chucking involves a wafer being electrostatically fixed to the

heater as discussed at col. 1, lines 17-19 of Kawada. Thus, this direct contact between the covering layer and the wafer being heated leaves no “space,” and most certainly no “space [that] is occupied by a gas” as claimed. The advantage of having the work-heating surface of the claimed roughness facing the work while spaced from this work by a gas atmosphere was detailed above and will not be repeated.

Similarly, new independent Claims 34-37 parallel respective independent Claims 1, 2, 4, and 5 but recite that a “supporting body” is provided “to hold a work to be heated apart from the work-heating surface,” instead of reciting the direct contact of independent Claims 1, 2, 4, and 5. New dependent Claims 38-41 further limit the “supporting body” of each respective parent claim to be either “a supporting pin or a lifter pin.” New dependent Claims 42-45 require the work to be a semiconductor wafer and the “supporting body” to be a “supporting pin” that holds the wafer a specified distance from the work-heating surface.

New independent Claim 46 is similar to previously presented independent Claim 29, except that this new independent claim also recites that a “supporting body” is provided that is “configured to hold a work to be heated apart from the work-heating surface,” instead of the Claim 29 recited “work-heating surface which is configured to face a work to be heated across a space between the work-heating surface and the work to be heated.” New dependent Claim 47 is like new dependent Claims 38-41 in specifying that the “supporting body” of the parent claim is either “supporting pin or a lifter pin.” New dependent Claim 48 is like new dependent Claims 42-45 in specifying that the work is a semiconductor wafer and that the “supporting pin” alternative of the parent claim is used to hold the wafer a specified distance from the work-heating surface.

As noted above, Kawada includes electrodes for electrostatic chucking, and this Kawada taught electrostatic chucking means that the work, a wafer, will be electrostatically fixed to the heater as discussed at col. 1, lines 17-19 of Kawada. Clearly, the Kawada

covering layer must then contact the work (wafer). Thus, the beneficial control of impurity vaporization based upon the work and work-heating surface having a spacing there between, as discussed above as to page 7, lines 26-31 of the specification, is not possible. Further, this Kawada covering layer is just that and cannot be reasonably equated to the “supporting body” recited by new independent Claims 34-37 and 46. In this respect, this layer is not an element that would be called a “supporting body” by those skilled in the art based upon the clear meaning of these terms and the disclosure in the present application. See In re Cortright, 165 F.3d 1353, 1358, 49 USPQ 2d 1464, 1467 (Fed. Cir. 1999). (“Although the PTO must give claims their broadest reasonable interpretation, this interpretation must be consistent with the one those skilled in the art would reach.”)

Furthermore, while Ushikawa teaches an apparatus for processing semiconductor wafers in which the bottom surface of a wafer is positioned above the mount surface of the apparatus by a distance of 0.5 mm to 2 mm³ by the use of lifting pins, Ushikawa is silent about any surface roughness, R_{max}, of this mount surface. Also, Ushikawa does not teach or suggest the cause-and-effect relationship between the surface roughness of the mount surface and obtaining control of impurity vaporization and/or uniform temperature as to the work being heated. Therefore, Ushikawa does not remedy the deficiencies of Kawada as discussed above.

Moreover, and as noted during the August 23, 2005, discussion, the Kawada included electrostatic chucking means that the work, a wafer, must be electrostatically fixed to the heater to be in direct contact with the heater covering layer as discussed above and at col. 1, lines 17-19 of Kawada. The suggested modification of Kawada to incorporate the Ushikawa lifting pins would involve a substantial redesign of Kawada and would destroy the intended operation of Kawada in terms of eliminating the Kawada taught electrostatic fixing

³ Ushikawa, column 4, lines 33-36.

of the work to be heated to the covering layer of the heater. See In re Ratti, 270 F. 2d 810, 813, 123 USPQ 349, 352 (CCPA 1959).

The rejection of Claim 16 under 35 U.S.C. §103(a) as unpatentable over Kawada in view of Noda, and further in view of Ushikawa is believed to be moot in view of the cancellation of Claim 16.

The rejection of Claim 19 under 35 U.S.C. §103(a) as unpatentable over Kawada in view of Nozaki and the rejection of Claim 20 under 35 U.S.C. §103(a) as unpatentable over Kawada in view of Noda in further view of Nozakis are also respectfully traversed.

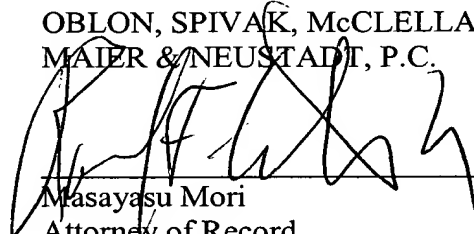
Nozaki does not cure the deficiencies of Kawada that were noted above as to the rejection of independent Claim 4 from which Claim 19 depends or as to independent Claim 5 from which Claim 20 depends. As further noted above, Noda also does not cure these deficiencies of Kawada.

Accordingly, it is respectfully submitted that Claim 19 is allowable for at least the same reasons as discussed above with respect to amended independent Claim 4 and that Claim 20 is allowable for at least the same reasons as discussed above with respect to amended independent Claim 5.

As no further issues are believed to be outstanding in this application, it is respectfully submitted that the present application is believed to be in condition for formal allowance, and an early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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A handwritten signature in black ink, appearing to read 'Masayasu Mori', is written over a horizontal line.

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